How to Correctly Stitch Together *Kepler* Data of a Blazhko Star

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Abstract One of the most challenging difficulties that precedes the frequency analysis of *Kepler* data for a Blazhko star is stitching together the data from different seasons (quarters). We discuss the preliminary steps in the stitching, detrending and rescaling process using the data for long-term Blazhko stars. We present the process on *Kepler* data of a Blazhko star with a variable Blazhko cycle and some first results of our analysis.

1 Stitching, Detrending and The Rescaling Process for *Kepler*

Several models have been proposed to explain the Blazhko effect (see e.g., [1]) but it still remains a problem to be solved. An additional difficulty for the analysis of

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Blazhko stars is that the data obtained in subsequent quarters display some discrepancies in their flux values. Therefore, when stitching together the light curves from different quarters, these discrepancies must be removed.

To overcome the problems originating from *Kepler* itself and/or from the "Automated Pipeline" routine, the users of the *Kepler* archive can use the PyKE[2] software. In this study, we applied the rescaling process to five Blazhko stars. After stitching the data for all quarters, the most notable difference is the flux offset between subsequent quarters originating mainly from the instrumental effects (see left panel of Fig. 1). Our rescaling process matches the light curves from consecutive quarters. This matching is based on the assumption that phase-ordered light curves with a few cycles closest to each other between two consecutive quarters must have nearly the same flux values at the same phases. The first parameter is the period of the star. Another parameter, the folding epoch, must be determined to carry out the phase ordering process. During the matching process, the corresponding flux values for the same phases between phase-ordered light curves of two consecutive quarters are determined and proportioned. Therefore, the phase scaling factors are determined for, and applied to short ranges of phase. The right panel of Fig. 1 represents a simple diagram of this approach for the rescaling process.

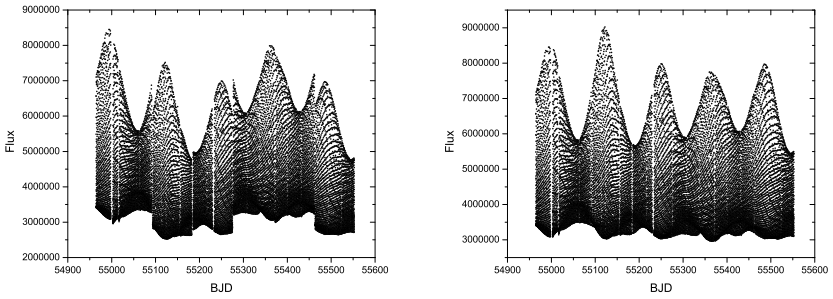

Fig. 1 The light curve of a Blazhko star, using the data from Q1 up to Q7 quarters without rescaling procedure (left panel), and with rescaling procedure (right panel)

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References

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